

## Lecture Module - Introduction

ME3023 - Measurements in Mechanical Systems

Mechanical Engineering

Tennessee Technological University

### Topic 2 - Types of Variables

## Topic 2 - Types of Variables

- Measured Variable
- Independent and Dependent Variables
- Controlled Variables and Parameters
- Extraneous Variables
- Engineering Examples

# Measured Variable

“A **measurement** is an act of assigning a specific value to a physical variable. That physical variable is the **measured variable**.”

Text: Theory and Design of Mech. Meas.

# Independent and Dependent Variables

“If a change in one variable will not affect the value of some other variable, the two are considered independent of each other. A variable that can be changed independently of other variables is known as an **independent variable**. A variable that is affected by changes in one or more other variables is known as a **dependent variable**. Normally, the variable that we measure depends on the value of the variables that control the process.”

Text: Theory and Design of Mech. Meas.

# Controlled Variables and Parameters

“A variable is **controlled** if it can be held at a constant value or at some prescribed condition during a measurement... ...complete control of a variable is not usually possible. We use the adjective **controlled** to refer to a variable that can be held as prescribed, at least in a nominal sense...

...we define a **parameter** as a functional grouping of variables. For example, a moment of inertia or a Reynolds number... ...A **parameter** that has an effect on the behavior of the measured variable is called a control parameter....”

Text: Theory and Design of Mech. Meas.

# Extraneous Variables

“Variables that are not or cannot be controlled during measurement but that affect the value of the variable measured are called **extraneous variables**. Their influence can confuse the clear relation between cause and effect in a measurement... ..The effects due to **extraneous variables** can take the form of signals superimposed onto the measured signal with such forms as **noise** and drift.”

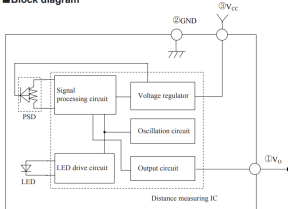
Text: Theory and Design of Mech. Meas.

# Engineering Examples

## Example 1: SHARP IR Ranger



■ Block diagram



Identify the following measurement stages

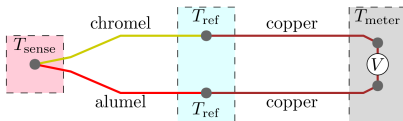
- Sensor: \_\_\_\_\_
- Transducer: \_\_\_\_\_
- Signal Conditioning: \_\_\_\_\_
- Output: \_\_\_\_\_

Name at least one for each of the following categories

- Measured Variable: \_\_\_\_\_
- Independent Variable(s):  
\_\_\_\_\_
- Dependent Variable(s):  
\_\_\_\_\_, \_\_\_\_\_
- Controlled Variable(s):  
\_\_\_\_\_, \_\_\_\_\_
- Extraneous Variable(s): \_\_\_\_\_

# Engineering Examples

## Example 2: Thermocouple with DMM



Identify the following measurement stages

- Sensor: \_\_\_\_\_
- Transducer: \_\_\_\_\_
- Signal Conditioning: \_\_\_\_\_
- Output: \_\_\_\_\_

Name at least one for each category

- Measured Variable: \_\_\_\_\_
- Independent Variable(s):  
\_\_\_\_\_
- Dependent Variable(s):  
\_\_\_\_\_
- Controlled Variable(s): \_\_\_\_\_
- Extraneous Variable(s): \_\_\_\_\_

Image, More Info: [Wikipedia](#)